Space Weather Technical Forecast

Issued on Wednesday, 10 August 2022 at 12:22 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight chance of Minor Geomagnetic Storms, especially on 10 and 11 August. Active electron fluence.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity has been Very Low over the past 24 hours, with no significant flare activity. There are five sunspot regions on the visible disc. Four of these are simple alpha regions, with one relatively stable beta region in the southwest quadrant. No CMEs were visible in available imagery.

Solar Wind / Geomagnetic Activity: Solar wind speeds have averaged between 550-600km/s over the last 24 hours, as the Earth continues to be affected by the high speed stream from coronal hole 10. Density has been around average. Total magnetic field strength was weak, with the north-south component, Bz, also varying weakly. Phi angle has been positive (towards the Sun) throughout the period. Geomagnetic activity was mostly Quiet, with one Active interval between 10/0300-0600UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV), as measured by GOES16, was at background levels. The high energy electron flux (greater than 2 MeV) started at moderate levels but soon increased to high levels, with a peak of 7180pfu at 09/1505UTC. The 24-hour integrated electron fluence is following an upward trend, with 2.08e8 integrated pfu observed at 10/0000UTC and 2.55e8 integrated pfu at 10/0900 UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Solar activity is likely to be Very Low or Low, with a slight chance of isolated C-class flares.

Solar Wind / Geomagnetic Activity: No CMEs feature in the current forecast. Solar wind speeds are expected to be mainly elevated and occasionally strong through the next three days due to a combination of high speed streams from coronal holes 10 and 12. A decline is then possible on day 4. Geomagnetic activity is expected to be mainly Quiet, but with a risk of Active or G1/Minor Storms between 10 to 12 August.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to remain at background levels. The high energy electron flux (greater than 2 MeV) is likely to continue at mostly high levels for much of the next few days, but with an overall reducing trend towards the end of the period. Electron fluence values are expected to be mainly Active (1e8 integrated pfu), with a low risk of Very Active values (1e9 integrated pfu) on 11 August then trend downwards through the remainder of the period.

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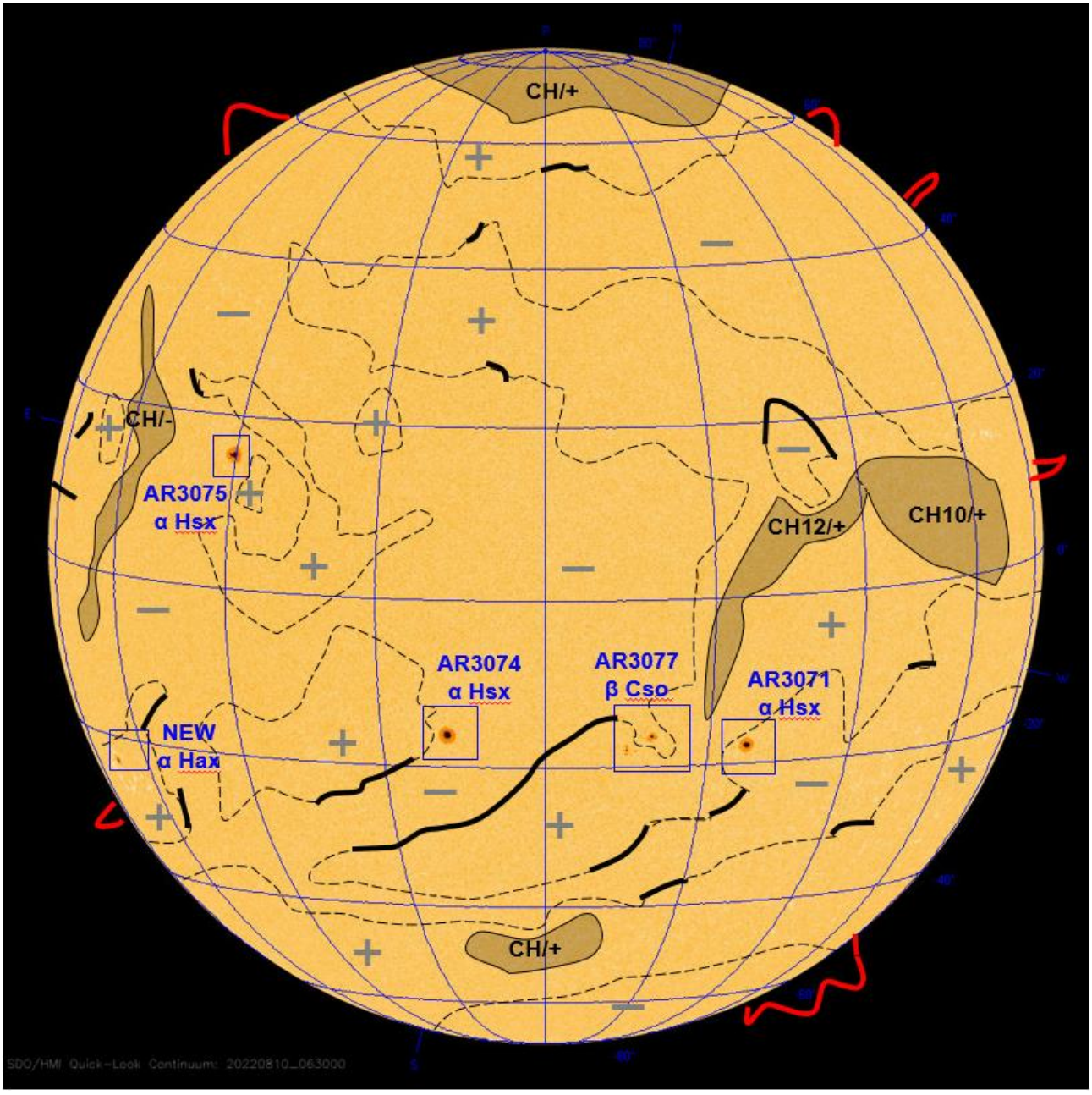
Figure 1. Solar Analysis Valid 10/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:
No CMEs feature in the current forecast, all previous filament lift-offs have been modelled as not being Earth-directed.

Solar winds are expected to be elevated through the next three days due initially to the high speed stream from coronal hole 10, followed closely by the high speed stream from linked coronal hole 12. As neither of these are recurrent features, STEREO-A data provides the best guide to the magnitude and duration of the high speed streams, as the Earth and the spacecraft are at similar latitudes. Recent data suggests 500-600km/s for coronal hole 10, with a potential increase indicated for coronal hole 12 potentially on day 2. Confidence in this is low in this increase however, with a chance that the increase on day 2 in the STEREO-A data could be related to a recent CME, which was directed at STEREO-A, but not Earth.

Geomagnetic activity is expected to be mainly Quiet to Unsettled through much of the period. There is a slight chance of Active or G1/Minor Storms through the next three days, with the lower risk at the end of the period, reflecting a lower confidence.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	10	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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Figure 2: Recent L1 solar wind data.

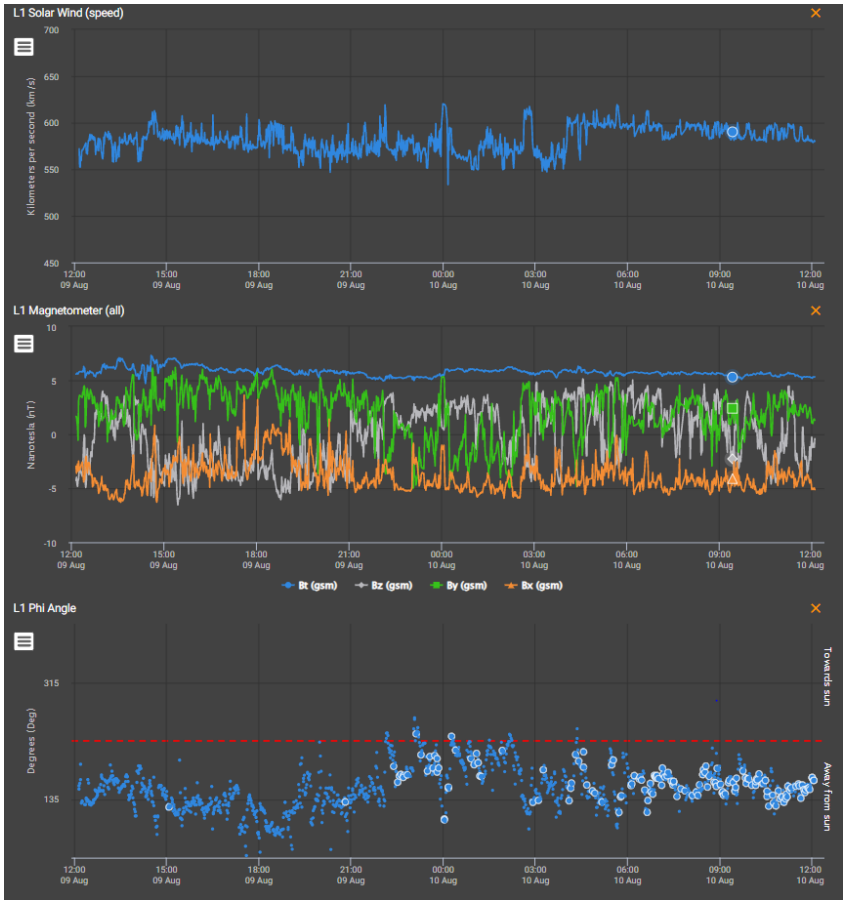
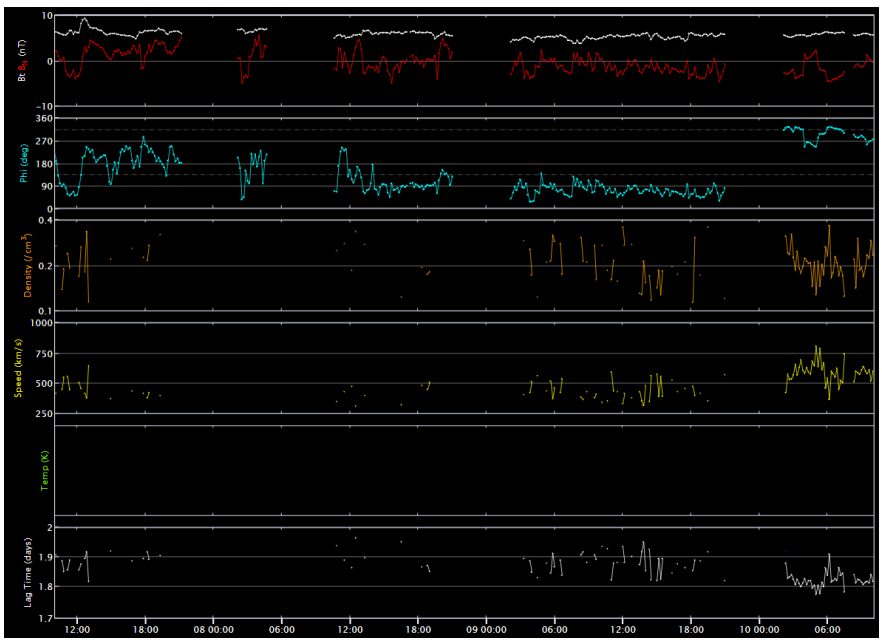


Figure 3: STEREO A data for the last three days. The increase mentioned in the text is towards the right of the chart



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Met Office Space Weather Technical Forecast

Radio Blackouts - X-Ray Flares:

Solar activity has been Very Low over the last 24 hours, with no significant activity observed. There are five regions on the visible disc, with all of these relatively simple, benign and inactive. Although no significant activity is currently forecast, analysis of STEREO A EUVI data suggests that further active regions could rotate onto the visible disc in the next four days.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels, and is expected remain at this level through the period barring development of significant sunspot regions.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons Event (≥ 2MeV):
Electron flux is expected to be at mainly high levels through the next few days, with a gradually reducing trend. There is a likelihood of predominantly moderate levels, especially on diurnal minimums towards the end of the period, as the high speed stream is expected to slowly wane. Fluence is above the Active (1e8 integrated pfu) threshold and is expected to remain above this level through the next three days, with a declining trend later in the period as the high speed stream eases. There is a low confidence that the fluence could peak briefly at Very Active (1e9 integrated pfu) levels on 11 August.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	100	90	80	60
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	5	10	5	1

Figure 4: GOES 16 electron flux and MOSWOC REFM model

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